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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
08/897,839	07/21/1997	YUHKO NISHIMOTO		4968

30132 7590 12/03/2003
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EXAMINER

MALDONADO, JULIO J

ART UNIT	PAPER NUMBER
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2823

DATE MAILED: 12/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

08/897,839

Applicant(s)

NISHIMOTO ET AL.

Examiner

Julio J. Maldonado

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 August 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 43, 47 and 53 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 43, 47 and 53 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 5) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 6) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

1. The non-final rejection as set forth in paper mailed on 04/07/2003 is withdrawn in response to applicants' request for reconsideration.
2. A new rejection is made as set forth in this Office Action.
3. The addition of claim 53 is acknowledged.
4. Claims 43, 47 and 53 are pending in the application.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 43 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Itoh et al. (U.S. 5,160,998) in view of Machado et al. (U.S. 5,098,865).

In reference to claim 43, Itoh et al. (Figs.6 and 8a-h' and column 3, line 56 – column 8, line 18) in a related art to the formation of metal wirings teach forming a first insulating layer (43) with compressive stress; forming an aluminum interconnection layer (34) on and in contact with said first insulating layer (43); forming a second insulating layer (44) with compressive stress on and in contact with said interconnection layer (34), wherein said interconnection layer (34) is sandwiched between and in contact with said first insulating layer (43) and said second insulating layer (44); and before forming said first insulating layer (43) or after forming said second insulating layer (44), forming a third insulating layer (42) with a second type of stress that is

different from said first type of stress, so as to adjust overall stress of said stress-adjusted insulating film, wherein the stress-adjusted insulating film has first through i-th insulating layers having the thickness t_1 through t_i , respectively, and wherein the stress in said insulating film is positive when tensile stress and negative when compressive stress (column 4, lines 46 – 62). Also, Itoh et al. teach adjusting the parameters of preparation of each insulating film to obtain a desired stress (column 4, lines 46 – 56).

Itoh et al. fail to teach wherein the stress-adjusted insulating film has first through i-th insulating layers having the thickness t_1 through t_i , respectively, wherein the thickness (t_i) of i-th insulating layer of said stress-adjusted film is determined so that the total stress (σ_T) of said overall stress-adjusted multilayered insulating film is less than $+2 \times 10^5$ dyne/cm, wherein said total stress (σ_T) is calculated as:

$$\sigma_T = \sum_{i=1}^n (t_i X \sigma_i)$$

However, Machado et al. in a related method to deposit a dielectric layer teach that the stress of a film depends on the film thickness, deposition rate, deposition temperature, method of film preparation, among other parameters (column 2, lines 59 – 65). Therefore, it would have been within the scope of one of ordinary skill in the art to combine the teachings of Itoh et al. and Machado et al. to enable the determination of the stress of the insulating layers of Itoh et al. to be performed according to the teachings of Machado et al. because one of ordinary skill in the art would have been motivated to look to alternative suitable methods of performing the disclosed determination of stress of the insulating layers of Itoh et al. and art recognized suitability

for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

Still, the combined teachings of Itoh et al. and Machado et al. fail to teach wherein the thickness of the i-th is stress-adjusted so that the total stress of said overall stress-adjusted multilayered insulating film is less than $+2 \times 10^5$ dyne/cm. However, one of ordinary skill in the art would have been led to adjust the thickness parameters as taught by Itoh et al. and Machado et al. to obtain said recited stress.

Still, the combined teachings of Itoh et al. and Machado et al. fail to expressly teach that the stress (σ_T) is of said stress-adjusted insulating film calculated as:

$$\sigma_T = \sum_{i=1}^n (t_i X \sigma_i)$$

However, this equation is inherent because it's a description of the relationship between the stress of the films governed by the physics and material properties. One of ordinary skill in the art would have been able to recite the relationship between the stress value for the i-th layer, because is routine optimization within the combined teachings of Itoh et al. and Machado et al.

In reference to claim 53, the combined references of Itoh et al. and Machado et al. teach performing a series of experiments, wherein a multilayered stack of insulating films are deposited one on top of the other in order to determine generation of cracks (Itoh et al., Fig.10 and column 8, line 26 – column 9, line 19). However, the combined teachings of Itoh et al. and Machado et al. fail to expressly teach repeating the deposition steps to produced a stress-adjusted multilayered insulating film wherein adjacent aluminum interconnection layers are separated by, in sequence, a first

insulating layer, a third insulating layer and a second insulating layer. However by using the teachings of Itoh et al., one of ordinary skill in the art would have been led to the recited multilayered dielectric stack in the claimed invention since this would be a result of routine experimentation.

7. Claim 47 is rejected under 35 U.S.C. 103(a) as being unpatentable over Itoh et al. ('998) in view of Machado et al. ('865) as applied to claims 43 and 53 above, and further in view of Matsuura et al. (U.S. 5,250,468).

The combined teachings of Itoh et al. and Machado et al. teach forming the first insulating layer (43) by plasma CVD process, and the second insulating film (44) by reactive gaseous mixtures (Itoh et al., column 4, lines 13-41), but fail to teach the reactive gaseous mixtures include at least organic silane and oxygen. However, Matsuura et al. in a related method to form insulating films teach forming dielectric layers using plasma CVD processes and organic silane and oxygen and reactive mixture (column 1, lines 10-32). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to form the dielectric layers of Itoh et al. with a gaseous mixture including at least organic silane and oxygen as taught by Matsuura et al., since this materials are commonly used to form dielectric layers (column 1, lines 10-32).

Response to Arguments

8. Applicant's arguments filed 08/07/2003 have been fully considered but they are not persuasive.

In reference to the Machado reference, applicants argue, "...An explanation of stress in a single-layer film does not suggest that total stress for a multilayered structure should even be considered, much less that such total stress should be less than some maximum value...". In response to this argument, applicants assert that Machado et al. is directed to a single-layered film. However, by controlling the parameters of the individual layers, the characteristics of the overall dielectric stack would be ultimately controlled. Therefore, the teachings of Machado et al. related to adjusting stress in a single layer are combined with the teachings of Itoh et al. related to forming a stack with stress adjusted properties in the rejection.

Also, applicants argue, "...Machado et al. teaches only that the stress depends on film thickness...". In response to this argument, Machado et al. teach that the stress in a film depends on thickness, deposition rate, deposition temperature, ambient pressure, method of film preparation, and type of substrate used, among other parameters (Machado et al., column 2, lines 60 – 64).

Conclusion


9. Papers related to this application may be submitted directly to Art Unit 2823 by facsimile transmission. Papers should be faxed to Art Unit 2823 via the Art Unit 2823 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2823 Fax Center number is **(703) 305-3432**. The Art Unit 2823 Fax Center is to be used only for papers related to Art Unit 2823 applications.

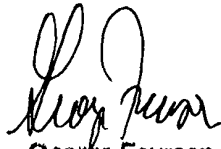
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Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Julio J. Maldonado** at **(703) 306-0098** and between the hours of 8:00 AM to 4:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via julio.maldonado@uspto.gov. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (703) 306-2794.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 308-0956**.


JMR
12/1/03


George Fourson
Primary Examiner